

MODIFIED POLYSACCHARIDES HAVING IMPROVED ABSORBENT PROPERTIES AND PROCESS FOR THE PREPARATION THEREOF

BACKGROUND OF THE INVENTION

This application is a divisional application of application Ser. No. 08/116,180 filed on Sep. 2, 1993, now U.S. Pat. No. 5,470,964, which is a continuation-in-part of U.S. Ser. No. 07/837,304, filed Feb. 14, 1992, now abandoned.

FIELD OF THE INVENTION

The present invention relates to modified polysaccharides having improved absorbent properties. Specifically, the present invention relates to a surface-crosslinked, modified polysaccharide having the ability to absorb liquid while under a load and a process for the preparation thereof.

DESCRIPTION OF THE RELATED ART

The use of absorbent materials, commonly known as superabsorbents, in disposable absorbent personal care products is known. Such absorbent materials are generally employed in absorbent products, such as diapers, training pants, adult incontinence products, feminine care products, and the like, in order to increase the absorbent capacity of such products while reducing their overall bulk. Such absorbent materials are generally present in absorbent products in a fibrous matrix, such as a matrix of wood pulp fluff. A matrix of wood pulp fluff generally has an absorbent capacity of about 6 grams of liquid per gram of fluff. The absorbent materials described above generally have an absorbent capacity of at least about 10, preferably of about 20, and often up to about 100 times their weight in water. Clearly, incorporation of such absorbent materials in personal care products can reduce the overall bulk while increasing the absorbent capacity of such products.

A wide variety of materials has been described for use as absorbent materials in such personal care products. Such materials include natural-based materials, such as agar, pectin, gums, carboxyalkyl starch, carboxyalkyl cellulose, and the like; as well as synthetic materials, such as polyacrylates, polyacrylamides, hydrolyzed polyacrylonitrile, and the like. While natural-based absorbent materials are known for use in personal care products, they have not gained wide usage in such products, at least in part, because their absorbent properties are generally inferior compared to synthetic absorbent materials, such as the polyacrylates. Specifically, many of the natural-based materials tend to form soft, gelatinous masses when swollen with a liquid. When employed in absorbent products, the presence of such soft, gelatinous masses tends to prevent the transport of liquid within the fibrous matrix in which the absorbent materials are incorporated. This phenomenon is known as gel blocking. Once gel blocking occurs, subsequent insults of liquid cannot be efficiently absorbed by the product, and the product tends to leak. Further, many of the natural-based materials exhibit poor absorption properties, particularly when subjected to external pressures. In contrast, the synthetic, absorbent materials are often capable of absorbing large quantities of liquids while maintaining a generally stiff, non-gelatinous character. Accordingly, the synthetic absorbent materials can be incorporated in absorbent products while minimizing the likelihood of gel blocking.

A number of approaches have been suggested to improve the liquid absorptive and retentive properties of various natural-based absorbent materials. For example, U.S. Pat. No. 3,723,413 issued Mar. 27, 1973, to Chatterjee et al. describes the heat treatment of a carboxyalkyl cellulose in the presence of remaining carboxyalkylating reactants and byproducts, such that the carboxyalkyl cellulose becomes water insoluble and possessed of desirable liquid absorptive and retentive properties and characteristics.

U.S. Pat. No. 3,379,720 issued Apr. 23, 1968, to Reed describes a process of preparing modified polysaccharides, such as ethers and esters of cellulose, comprising slurring a water-soluble polysaccharide in an inert medium, acidifying said polysaccharide, removing excess acid from the acidified polysaccharide, drying same and heat curing.

U.S. Pat. No. 4,689,408 issued Aug. 25, 1987, to Gelman et al. describes a method of preparing salts of carboxymethyl cellulose. The method involves treating a carboxymethyl cellulose with water, adding a nonsolvent for the carboxymethyl cellulose, and recovering the carboxymethyl cellulose. The carboxymethyl cellulose is said to have an absorbency of at least 25 grams of liquid per gram of carboxymethyl cellulose.

The natural-based polysaccharide materials are often water soluble. Accordingly, it is necessary to render the materials generally water insoluble when the materials are intended for use in personal care products. Many known methods of introducing a degree of water insolubility into absorbent materials involve the bulk crosslinking of the absorbent material. Unfortunately, such bulk-crosslinked absorbent materials are not always possessed of desirable liquid-absorbent and retentive properties. In an attempt to improve these properties, several surface-treating processes have been suggested.

U.S. Pat. No. 4,043,952 issued Aug. 23, 1977, to Ganslaw et al. is directed to a surface-treatment process for improving dispersibility of an absorbent composition. Disclosed is a means of improving the aqueous dispersibility of a water-absorbent composition, through the use of a surface treatment which, ionically, complexes the surface thereof to a moderate degree.

U.S. Pat. No. 4,666,983 issued May 19, 1987, to Tsubakimoto et al. is directed to an absorbent article. The absorbent article is obtained by mixing 100 parts by weight of an absorbent resin powder having a carboxyl group with a crosslinking agent having at least two functional groups capable of reacting with a carboxyl group. The absorbent resin powder is said to become crosslinked at least in the vicinity of the surface of the absorbent resin powder.

U.S. Pat. No. 5,026,800 issued Jun. 25, 1991, to Kimura et al. is directed to a water-absorbent resin and production process. Disclosed is a water-absorbent resin prepared by polymerizing an aqueous solution of a water-soluble, ethylenically-unsaturated monomer, pulverizing and sieving the gel-like polymer so obtained, and crosslinking the surface of the polymer powder.

SUMMARY OF THE INVENTION

It is desirable to develop and produce a natural-based absorbent material having absorptive properties similar to synthetic, highly absorbent materials and, thus, suited for use in personal care absorbent products.

The present invention concerns a method for producing a surface-crosslinked, modified polysaccharide. The method comprises the step of forming a mixture comprising water